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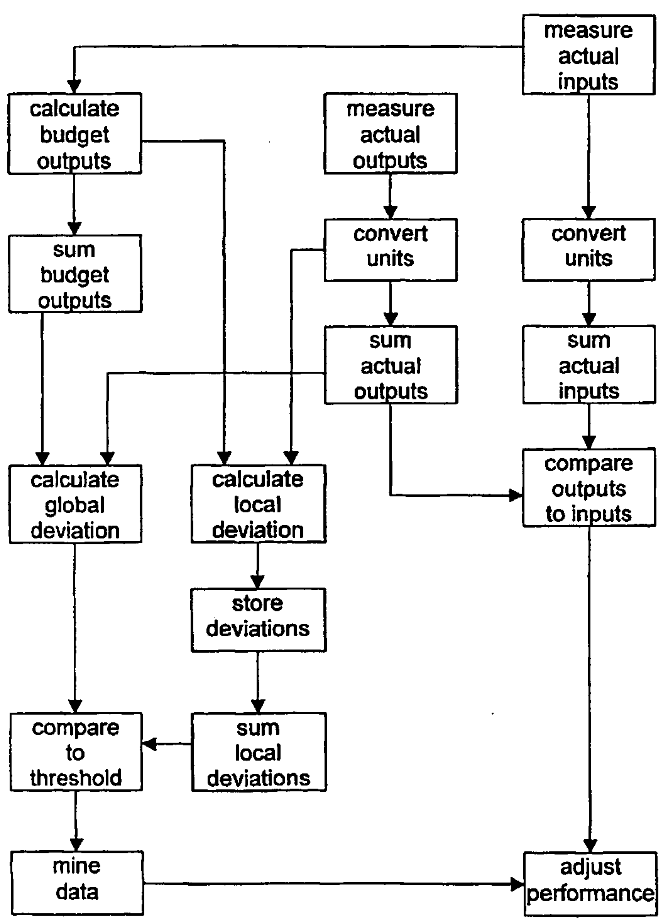

(57) Abstract: A method of monitoring the performance of a business by calculating actual output values and budgeted output values for measured input values at a unit, component or sub-component level. The budgeted output values are determined from key performance indicators using suitable models for the specific activity. Values are converted to a common unit system, for example dollars.A deviation between the actual output value and the budgeted output value is calculated, stored and summed at each level. The total deviation across the business is compared to a threshold. If the total deviation is unacceptable the stored data is mined to identify the source of the variation.

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METHOD OF BUSINESS ANALYSIS

This invention relates to improvements in management information systems for monitoring performance of a business (multinational corporation, company or small to medium enterprise). In particular, it relates to a modeling and analysis framework that describes a business, and a method of using the framework to analyze the performance of the business and identify opportunities to improve the performance of the business.

BACKGROUND TO THE INVENTION

Modern management practices highlight the need to monitor and improve the performance of all aspects of a business. This can be achieved by identifying key performance indicators at each level within a business and then monitoring the key performance indicators against target values. The target values can be determined from historical data or by modeling of the relevant aspect of the business. Typically a model is developed for a particular area, say a plant process model or a business process model, and is typically confined to that area. These models are used to forecast expected results for a plant or a business process.

One example of this approach is the familiar budgeting process for financial management. A budget can be set based on historical performance or desired future performance. For a small business the setting of a budget is a relatively straightforward process. For larger businesses the problem is somewhat more intractable and generally dealt with by assigning separate budgets to each operational unit within the business, and perhaps components and sub-components within each unit.

The same approach can be used with every unit, component, and sub-component within a business, whether financial or otherwise. For example, a power generation business may have a range of financial assets and physical assets. One physical asset will be a power generation station that can be considered as a unit of the business. This unit may be made up of a number of power utility components which are in turn made up from a number of sub-components, such as boilers, pumps, heaters, condensers, turbines, etc. Each sub-component can be monitored for deviation from a target performance based on output for resources in. The development of key performance indicators across a business and at all levels within a business is known but it has proven difficult to analyze and draw conclusions from the volume of information that is collected.

Efficient operation of a business requires an understanding of how each unit, component and sub-component is contributing to the overall performance of the business. In an attempt to obtain this understanding large amounts of information concerning the operation of a business are typically gathered and subsequently analysed. No suitable framework for organising and analysing this information exists so it is currently necessary to compress the collected data to a tractable level. Data compression involves combining data from a number of sub-components and/or components into a single indicator to represent the performance of the collated sub-components and/or components. Data compression is not reversible so most of the detailed data on the performance of the business is lost. Furthermore, the absence of a framework for collecting and storing the captured data means that information is stored in a manner that effectively prevents intelligent analysis of the information. Although the current management systems will indicate when a unit, and perhaps a component, is performing below target, the current systems do not allow the captured data to be mined to identify the

particular key performance indicators contributing to the underperformance or allow for a structured analysis of where performance improvements can be made.

Other problems associated with present business information systems relate to the lack of integration between different sections of a business. This primarily occurs because different sections such as plant and human resources are typically monitored differently making subsequent integration difficult. By way of example, a plant section involving power unit components may be monitored in one respect by the power output in megawatts. The performance of another section of the business may be measured in terms of the financial return on shares. Because of the different ways in which these different sections of the business are measured it is difficult to firstly combine them and other sections of the business to determine the overall performance of the business, and secondly to compare their contribution to the overall performance of the business.

It is therefore desirable to provide a method of measuring the overall performance of a business by combining the performance of each of the different sections (units, components, sub-components) of a business and across the various facets of the section (efficiency, reliability, capacity, safety, environmental impact, risk). It is also desirable to provide a method of determining the contribution of different sections of a business to the overall performance of the business and where the best improvements are possible for financial return and risk management.

DISCLOSURE OF THE INVENTION

In one form, although it need not be the only or indeed the broadest form, the invention resides in a method of monitoring the performance of a business including the steps of:

determining key performance indicators for one or more sections of

the business;
determining a target value for each key performance indicator;
measuring an actual value for each key performance indicator;
measuring a deviation between the target value and the actual value;
storing the actual value and deviation for each key performance indicator;
summing the actual values and the deviations to provide a global measure of performance of the business in terms of a global actual value and a global deviation;
wherein a significant global deviation is tracked to one or more contributing key performance indicators to identify the section and/or sections primarily contributing to the global deviation.

In preference, the step of determining a target value for each key performance indicator includes the steps of selecting an appropriate model, setting parameters for the model, and calculating a target value from an input value.

Improvement of the business can be achieved by simulating changes to the performance and controllable parameters of the model for each section of the business to determine the impact on the overall performance of the business. The value associated with changes in the performance and controllable parameters is put into the same framework so that the system considers the cost-benefit of the change as part of the analysis.

Risk exposure to the business can be achieved by simulating changes to the uncontrollable parameters of the model for each section of the business to determine the impact on the overall performance of the business. The value associated with changes in uncontrollable parameters is put into the same framework so that the system considers the fluctuations in cost of the change as part of the analysis.

In another form the invention resides in a method of monitoring the performance of a business including the steps of:

(a) determining input values X_i for each key performance indicator KPI_i for each of one or more sub-components of the business;

(b) converting each input value X_i to corresponding input values Y_i that are measured in units which are common for all key performance indicators KPI_i;

(c) measuring output values Z_i for each X_i;

(d) converting each output value Z_i to corresponding output values W_i that are measured in units which are common for all key performance indicators KPI_i;

(e) calculating a total input $Y_{i.tot}$ for the business which is based on the Y_i values of each KPI_i and the relationship between each KPI_i of the business;

(f) calculating a total output $W_{i.tot}$ for the business which is based on the W_i values of each KPI_i and the relationship between each KPI_i of the business; and

(g) comparing the total output $W_{i.tot}$ to the total input $Y_{i.tot}$ as a measure of performance of the business.

Suitably $W_{i.tot}$ is calculated as the summation of W_i for all i, and $Y_{i.tot}$ is calculated as the summation of Y_i for all i.

The method of monitoring the performance of a business may further include the steps of:

(h) calculating budget output values B_i from the input values Y_i and a model for each KPI_i;

(i) calculating a deviation value D_i for each KPI_i which is the difference between the budget output value B_i and the actual output value W_i;

(j) calculating a total deviation value $D_{i.tot}$ which is based on the D_i values of each KPI_i and the relationship between each KPI_i of the business;

(k) comparing the total deviation value $D_{i.tot}$ to a threshold T as a measure of performance of the business.

The method may also include the steps of:

(l) calculating a total budget output value $B_{i.tot}$ which is based on the B_i values of each KPI_i and the relationship between each KPI_i of the business;

(m) calculating a global deviation G between the total budget output value $B_{i.tot}$ and the total output $W_{i.tot}$ for the business; and

(n) comparing the global deviation value G to a threshold T as a measure of performance of the business.

Suitably $B_{i.tot}$ is calculated as the summation of B_i for all i.

The method may further include the steps of:

(o) mining the deviation values D_i when either the global deviation G or the total deviation value $D_{i.tot}$ exceeds the threshold T to identify the KPI_i or KPI_i's that contribute to the global deviation G in a significant manner.

The method may also include the step of:

(p) quantifying improvment to the business by systematically changing controllable parameters P_c of the model for a KPI_i and relating a value of the change to P_c to the value associated with $W_{i.tot}$ or $D_{i.tot}$ as a result of the change to P_c;

and/or may include the step of:

(q) quantifying the risk a business is exposed to by systematically changing uncontrollable parameters P_u of the model for a KPI_i within an expected range and relating a value of the

change to P_u to the value associated with the $W_{i.tot}$ or $D_{i.tot}$ as a result of the change to P_u.

In a still further form the invention resides in a computer implemented method of monitoring the performance of a business by performing the steps (a) to (g) above and optionally performing one or more of the steps (h) to (q).

BRIEF DESCRIPTION OF THE DRAWINGS

To assist in understanding the invention, preferred embodiments will be described with reference to the following figures in which:

FIG 1 is a schematic representation of a business for the purpose of describing the invention;

FIG 2 shows schematically the hierarchical structure of the business of FIG 1;

FIG 3 represents the determination of budget outputs and actual outputs for a given input to a key performance indicator;

FIG 4 is a flow chart showing the operation of the method;

FIG 5 is a practical example of the working of the invention; and

FIG 6 is a schematic of a computer system useful for implementing the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG 1, there is shown a block diagram that conceptually represents an operating business. The business is made up of a number of operating units. The number of operating units will depend on the size and nature of the business. To effectively work the invention the business should be completely described by the operating units. Operating units may be physical, financial, or other. In

the specific example discussed below the business is a power generation utility with a power station as one physical unit and the share register as another financial unit.

Each operating unit is further described in detail as consisting of multiple components, which may be further broken down to sub-components. The performance of the business is measured against a range of key performance indicators (KPI) that apply at the lowest level of the business. Each component (or sub-component) will have a number of associated key performance indicators that are designed to provide measures of the health of the business. There may also be additional key performance indicators that are calculated at a macro level for components and units.

Another representation of the same structure is shown in FIG 2, but highlighting the hierarchical structure of a business. The performance measured by each KPI is an accumulative measure of the overall performance of the business. Thus, referring to FIG 3, for each KPI the actual output Z_i is monitored relative to the actual input X_i. A budget value B_i is calculated from the actual input X_i for each KPI. The difference between the budget value B_i and the actual output value Z_i is an indication of the efficiency.

The budget value is calculated using suitable models for the particular KPI applicable to the sub-component, component or unit. The selected key performance indicators are peripheral to the method of the invention. Persons skilled in the art will be aware of models and management systems based on the key performance indicator concept. This invention is not concerned directly with the key performance indicators, but rather a method of using the key performance indicators to analyze the overall performance of the business at a global level while maintaining information at a local level for detailed analysis.

The actual value and the deviation between the actual and budget values are recorded by the method. The values are summed across the hierarchy to provide the global measure and intermediate values.

The method is described in greater detail in FIG 4. As shown in FIG 4, the method commences with the measurement of the actual input values X_i. The input values X_i will have units appropriate for the KPI. For example, a financial unit will have KPI's measured in dollars whereas a physical unit will have KPI's measured in, for example, Megawatts or kilograms of produce, etc. In order to allow comparison between units and summation of global indicators it is necessary to convert the X_i values to a common value base. The inventors have found that a financial basis is most appropriate. Therefore, the X_i values are converted to Y_i values measured in dollars.

Although financial units provide an appropriate common basis for implementing the invention it should be understood that the invention is not limited to conversion of measured values to financial units. Any other basis is acceptable if conversion to the selected common units is possible. For those units already using the selected common units the conversion process will be unity process (no conversion or multiplication by one).

The converted input values Y_i may be summed across KPI's to give a sub-component input value, which may in turn be summed to give a component input value, a unit input value and a total business input value, $Y_{i.tot}$.

The actual output Z_i from each KPI is measured and converted to the same common units to give a converted value W_i. The converted values W_i may be summed to give total values $W_{i.tot}$ at the sub-component, component, unit, and business level. At each level the total measured output values $W_{i.tot}$ and the total input values $Y_{i.tot}$ can be compared to give a first indication of the performance of the

business. By systematically changing controllable parameters P_c and determining the influence on $W_{i.tot}$, local and global optimization is possible from within the same analysis structure. By systematically changing the uncontrollable parameters P_u and determining the influence on $W_{i.tot}$, the risk that the business is exposed to due to uncontrollable influences can be estimated from within the same analysis structure.

As seen in FIG 4, the measured inputs X_i are used to calculate budget outputs B_i. The budget outputs are expressed in the selected common unit. The calculation of the budget input will normally require conversion of the measured inputs to the appropriate units. A budget output (target performance) for an engineering component may be based on the design performance of the component, a non-engineering component target performance may be based on other performance indicators like rate of return, earnings before interest, or earnings before tax.

A local deviation D_i for each KPI is calculated by comparing the converted actual output W_i with the calculated budget output B_i. The local deviations D_i are stored and summed to provide total deviations $D_{i.tot}$ at the sub-component, component, unit, or and business level. At the business level the total deviation $D_{i.tot}$ is compared to a threshold T to determine if the business is operating within acceptable limits. A deviation greater than the acceptable threshold is an indication of some aspect of the business performing at an unacceptably inefficient level. The stored data is mined through the hierarchical structure depicted in FIG 2 to determine the specific sub-component that is under-performing. Corrective action may then be taken.

The method depicted in FIG 4 also provides for a global measure of efficiency G to be determined by calculating the difference between the summed total $B_{i.tot}$ of the individual budget outputs B_i and the summed total $W_{i.tot}$ of the converted actual outputs W_i. The global

efficiency value G is compared to a threshold T which may be the same threshold as discussed above. If the value G is greater than the threshold T the stored deviation data is mined to identify the problem component or sub-component. Efficiency values G can be determined at each level within the business, depending on the level of management adopted.

As indicated in FIG 4, the method leads to adjustment of performance to correct or improve the deviation. How performance is adjusted does not form part of the invention. Persons skilled in management of individual business units will appreciate the manner in which correction of operating conditions in a component can impact on the overall performance of a business. The invention quantifies the impact of the improvement

The method described above facilitates simple evaluation of the performance of a business yet maintains detailed information on performance at all levels of a business. It therefore substantially overcomes the data compression problems discussed earlier. Furthermore, it greatly reduces the amount of analysis, and therefore time, required to identify the cause of a deviation from budget and to seek improvements available from changes to controllable parameters. The method provides a structured mechanism to allocate limited resources to rectification of performance deviations and provide performance improvements across an entire business structure to the greatest benefit of the business.

As the method is component based a business can change its portfolio of components without changing the method. Individual components, and the parts of the hierarchy below that component, can be activated and deactivated to reflect the changes in the business. This makes maintenance of the method a straightforward task.

In complex businesses, the strict hierarchical structure shown in FIG 2 may be difficult to establish. Some units may involve inputs from components or sub-components used in other units. The method provides links between common components to pass output values between components since a common system of units, eg dollars, is used throughout the system.

A specific example of the working of the method for a power generation utility is shown in FIG 5. In a hierarchical structure the utility is considered as formed from two units, a power station and shares. The power station has two power unit components, power unit A and power unit B. Each component contains a number of sub-components, which are shown in FIG 5 for power unit B. Power unit A will have a similar structure. Each component is modeled to provide a budgeted output for a given input. The specific values for the generator sub-component are shown. The input cost is $4.25 for an actual output value of $5.3333 and a budgeted output of $5.423. This represents a deviation of $0.0897.

This deviation is shown in FIG 5 in dollar terms. The actual generator model is likely to be constructed on the basis of a mass balance or an energy balance. All inputs and outputs can be given a dollar value to calculate the net dollar value of inputs and the net dollar value of outputs so that the values can be passed to the next component and the deviation value can be passed up the hierarchy.

Similar detail is calculated for each sub-component to obtain the deviations shown. The sub-component deviations are summed to obtain a component deviation, $D_{i.tot}$ of $0.6667. Similarly the power unit A deviation is calculated as $0.3333. These component variations are summed to obtain a unit deviation of $D_{I.tot}$=$1.00.

The shares are considered in two packets, packet A and packet B. As shown in FIG 5 the component variations sum to a unit variation of –$0.1. The total deviation for the power utility is $0.90. If this

deviation is unacceptable the data can be mined to determine that the major cause of the deviation is the poor efficiency of the condenser and turbine in power unit B.

A suitable environment for working the invention is depicted in FIG 6. The performance of each component or sub-component is modeled analytically in software that runs on a computer, which in many cases will be a desktop computer, such as 1. The modeling would have three modes of operation within the same analysis structure namely monitoring, optimization and risk assessment. In monitoring mode the actual inputs are used. In optimization mode the controllable parameters are systematically changed and in risk assessment mode, the uncontrolable parameters are systematically changed.

The desktop computer 1 will have processing means 1a that receives a measure of the input values, X_i for calculation of the key performance indicator KPI_i. The input values X_i may be converted to corresponding input values W_i in the processing means 1a. The target output value B_i is calculated by the processing means 1a and may be displayed locally on display means 1b. The actual output Z_i is also measured and received by the computer 1, and may be converted to corresponding output value Y_i in the processing means 1a. The target output B_i, corresponding actual output Y_i, and calculated deviation D_i are displayed on the display means 1b. These values, as well as the raw data, are stored in a local storage device in the computer 1.

There may be a separate computer, such as 2, for each component or sub-component. In some circumstances it may be possible for a single computer, such as 3, to monitor two or more key performance indicators.

Each of the computers 1, 2, 3 are connected by a local area network 4 to a unit server 5 which collates the deviations D_i of each

component or sub-component within the unit, as well as calculates a total input, total output, and total budget for the unit.

As mentioned above, a business may consist of multiple units so the arrangement may be repeated, such as 6 and 7. The various user servers are connected by a wide area network 8 to a business server 9 that sums the deviations D_i across the business to obtain $D_{i.tot}$, and calculates $Y_{i.tot}$, $B_{i.tot}$, and $W_{i.tot}$, as described earlier. The business server 9 also calculates the global deviation G and displays the various measures and deviations on display means 10. The display may be graphical and contain time sequences of data against a suitable time base. The raw data may be stored at the business server 9 or in the unit server, such as 5.

The business server may 9 be configured to operate semi-automatically to indicate an alarm if the global deviation G exceeds the threshold T. In this case the user can mine the stored data to identify the component or sub-component that is performing with significant deviation from the target key performance indicator. Communication throughout the system shown in FIG 6 is therefore two way.

Throughout the specification the aim has been to describe the invention without limiting the invention to any particular combination of alternate features.

CLAIMS

1. A method of monitoring the performance of a business including the steps of:
determining key performance indicators for one or more sections of the business;
determining a target value for each key performance indicator;
measuring an actual value for each key performance indicator;
measuring a deviation between the target value and the actual value;
storing the actual value and deviation for each key performance indicator; and
summing the actual values and the deviations to provide a global measure of performance of the business in terms of a global actual value and a global deviation;
wherein a significant global deviation is tracked to one or more contributing key performance indicators to identify the section and/or sections primarily contributing to the global deviation.

2. The method of claim 1 wherein the step of determining a target value for each key performance indicator includes the steps of selecting an appropriate model, setting parameters for the model, and calculating a target value from an input value.

3. The method of claim 2 further including the step of simulating the impact of change on a performance of the business by changing controllable parameters of the model.

4. The method of claim 2 further including the step of simulating the impact of risk on a performance of the business by changing uncontrollable parameters of the model.

5. A method of monitoring the performance of a business including the steps of:

(a) determining input values X_i for each key performance indicator KPI_i for each of one or more sub-component of the business;

(b) converting each input value X_i to corresponding input values Y_i that are measured in units which are common for all key performance indicators KPI_i;

(c) measuring output values Z_i for each X_i;

(d) converting each output value Z_i to corresponding output values W_i that are measured in units which are common for all key performance indicators KPI_i;

(e) calculating a total input $Y_{i.tot}$ for the business which is based on the Y_i values of each KPI and the relationship between each KPI of the business;

(f) calculating a total output $W_{i.tot}$ for the business which is based on the W_i values of each KPI and the relationship between each KPI of the business; and

(g) comparing the total output $W_{i.tot}$ to the total input $Y_{i.tot}$ as a measure of performance of the business.

6. The method of claim 5 wherein $W_{i.tot}$ is calculated as the summation of W_i for all i, and $Y_{i.tot}$ is calculated as the summation of Y_i for all i.

7. The method of claim 5 further including the steps of:

(h) calculating budget output values B_i from the input values Y_i and a model for each KPI_i;

(i) calculating a deviation value D_i for each KPI_i which is the difference between the budget output value B_i and the actual output value W_i;

(j) calculating a total deviation value $D_{i.tot}$ which is based on the D_i values of each KPI_i and the relationship between each KPI_i of the business;

(k) comparing the total deviation value $D_{i.tot}$ to a threshold T as a measure of performance of the business.

8. The method of claim 5 further including the steps of:

(h) calculating budget output values B_i from the input values Y_i and a model for each KPI_i;

(l) calculating a total budget output value $B_{i.tot}$ which is based on the B_i values of each KPI_i and the relationship between each KPI_i of the business;

(m) calculating a global deviation G between the total budget output value $B_{i.tot}$ and the total output $W_{i.tot}$ for the business; and

(n) comparing the global deviation value G to a threshold T as a measure of performance of the business.

9. The method of claim 8 wherein $B_{i.tot}$ is calculated as the summation of B_i for all i.

10. The method of claim 7 further including the steps of:

(o) mining the deviation values D_i when the total deviation value $D_{i.tot}$ exceeds the threshold T to identify the KPI_i or KPI_i's that contribute to the total deviation $D_{i.tot}$ in a significant manner.

11. The method of claim 8 further including the steps of:

(p) mining the deviation values D_i when the global deviation G exceeds the threshold T to identify the KPI_i or KPI_i's that contribute to the global deviation G in a significant manner.

12. The method of claim 7 or 8 further including the step of:
(q) quantifying improvement to the business by systematically changing controllable parameters P_c of the model for a

KPI_i and relating a value of the change to P_c to the value associated with $W_{i.tot}$, and $D_{i.tot}$ or G as a result of the change to P_c.

13. The method of claim 7 or 8 further including the step of:

(r) quantifying the risk a business is exposed to by systematically changing uncontrollable parameters P_u of the model for a KPI_i within an expected range and relating a value of the change to P_u to the value associated with the $W_{i.tot}$, $D_{i.tot}$ or G as a result of the change to P_u.

14. A computer implemented method of monitoring the performance of a business including the steps of:

(a) recording input values X_i for each key performance indicator KPI_i for each of one or more sub-components of the business;

(b) converting each input value X_i to corresponding input values Y_i that are measured in units which are common for all key performance indicators KPI_i;

(c) recording output values Z_i for each X_i;

(d) converting each output value Z_i to corresponding output values W_i that are measured in units which are common for all key performance indicators KPI_i;

(e) calculating a total input $Y_{i.tot}$ for the business which is based on the Y_i values of each KPI_i and the relationship between each KPI_i of the business;

(f) calculating a total output $W_{i.tot}$ for the business which is based on the W_i values of each KPI_i and the relationship between each KPI_i of the business; and

(g) comparing the total output $W_{i.tot}$ to the total input $Y_{i.tot}$ as a measure of performance of the business.

15. The computer implemented method of claim 14 further including the steps of:

(h) calculating budget output values B_i from the input values Y_i and a model for each KPI_i;

(i) calculating a deviation value D_i for each KPI_i which is the difference between the budget output value B_i and the actual output value W_i;

(j) calculating a total deviation value $D_{i.tot}$ which is based on the D_i values of each KPI and the relationship between each KPI_i of the business;

(k) comparing the total deviation value $D_{i.tot}$ to a threshold T as a measure of performance of the business; and

(l) displaying on a display means the values $D_{i.tot}$, T, $Y_{i.tot}$ and $W_{i.tot}$.

16. The computer implemented method of claim 14 further including the steps of:

(h) calculating budget output values B_i from the input values Y_i and a model for each KPI_i;

(m) calculating a total budget output value $B_{i.tot}$ which is based on the B_i values of each KPI_i and the relationship between each KPI_i of the business;

(n) calculating a global deviation G between the total budget output value $B_{i.tot}$ and the total output $W_{i.tot}$ for the business;

(o) comparing the global deviation value G to a threshold T as a measure of performance of the business; and

(p) displaying on a display means the values G, T, $B_{i.tot}$, $W_{i.tot}$, and $Y_{i.tot}$.

17. The method of claim 15 further including the steps of:

(q) mining the deviation values D_i when the total deviation value $D_{i.tot}$ exceeds the threshold T to identify the KPI_i or KPI_i's that contribute to the total deviation $D_{i.tot}$ in a significant manner.

18. The method of claim 16 further including the steps of:

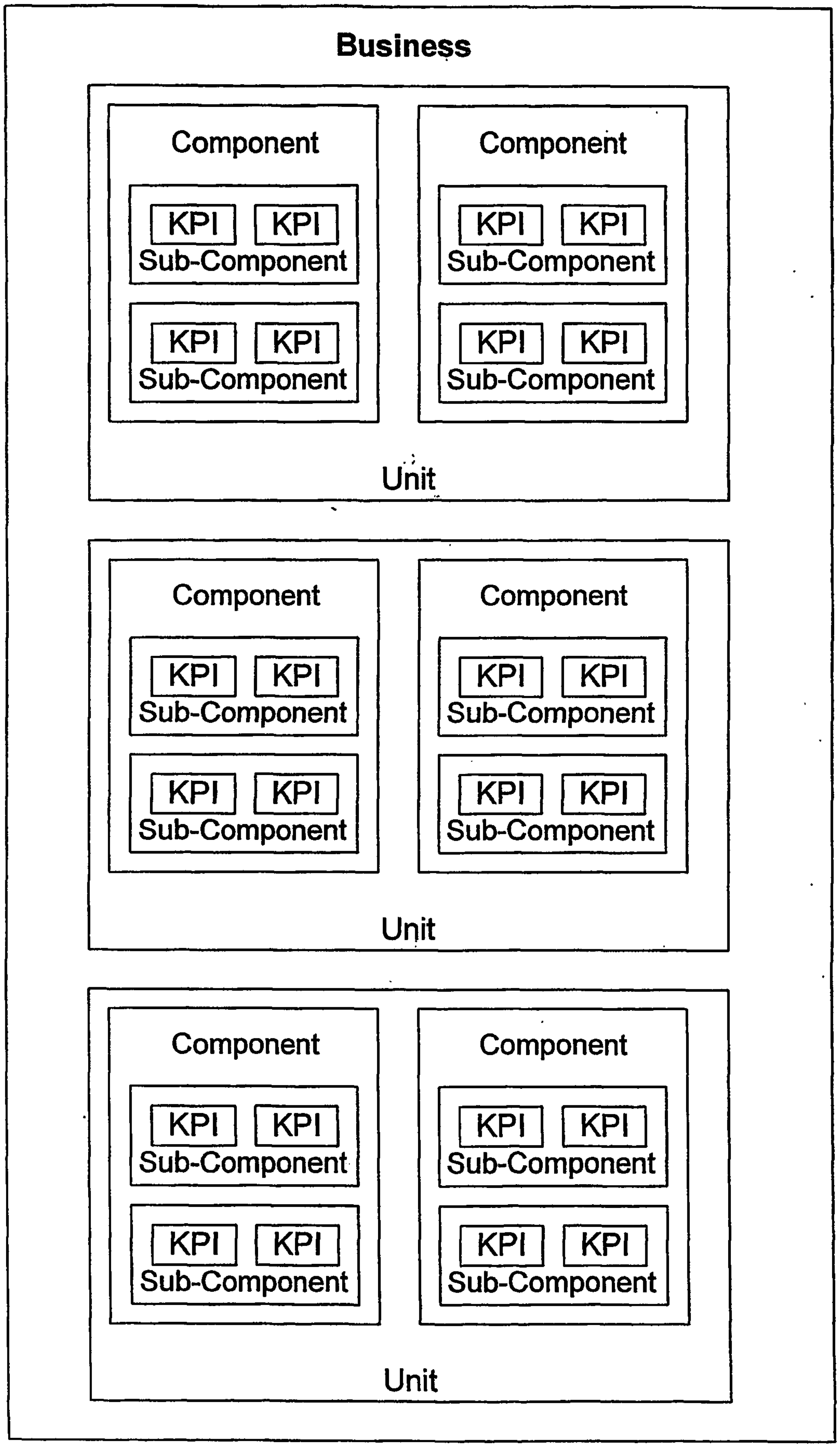
(r) mining the deviation values D_i when the global deviation G exceeds the threshold T to identify the KPI_i or KPI_i's that contribute to the global deviation G in a significant manner.

19. The computer implemented method of claim 15 or 16 further including the step of:

(s) quantifying improvement to the business by systematically changing controllable parameters P_c of the model for a KPI_i and relating a value of the change to P_c to the value associated with $W_{i.tot}$, and $D_{i.tot}$ or G as a result of the change to P_c.

20. The computer implemented method of claim 15 or 16 further including the step of:

(t) quantifying the risk a business is exposed to by systematically changing uncontrollable parameters P_u of the model for a KPI_i within an expected range and relating a value of the change to P_u to the value associated with the $W_{i.tot}$, $D_{i.tot}$ or G as a result of the change to P_u.


Business
Component
KPI
KPI
Sub-Component
KPI
KPI
Sub-Component
Component
KPI
KPI
Sub-Component
KPI
KPI
Sub-Component
Unit
Component
KPI
KPI
Sub-Component
KPI
KPI
Sub-Component
Component
KPI
KPI
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Unit
Component
KPI
KPI
Sub-Component
KPI
KPI
Sub-Component
Component
KPI
KPI
Sub-Component
KPI
KPI
Sub-Component
Unit

FIG 1

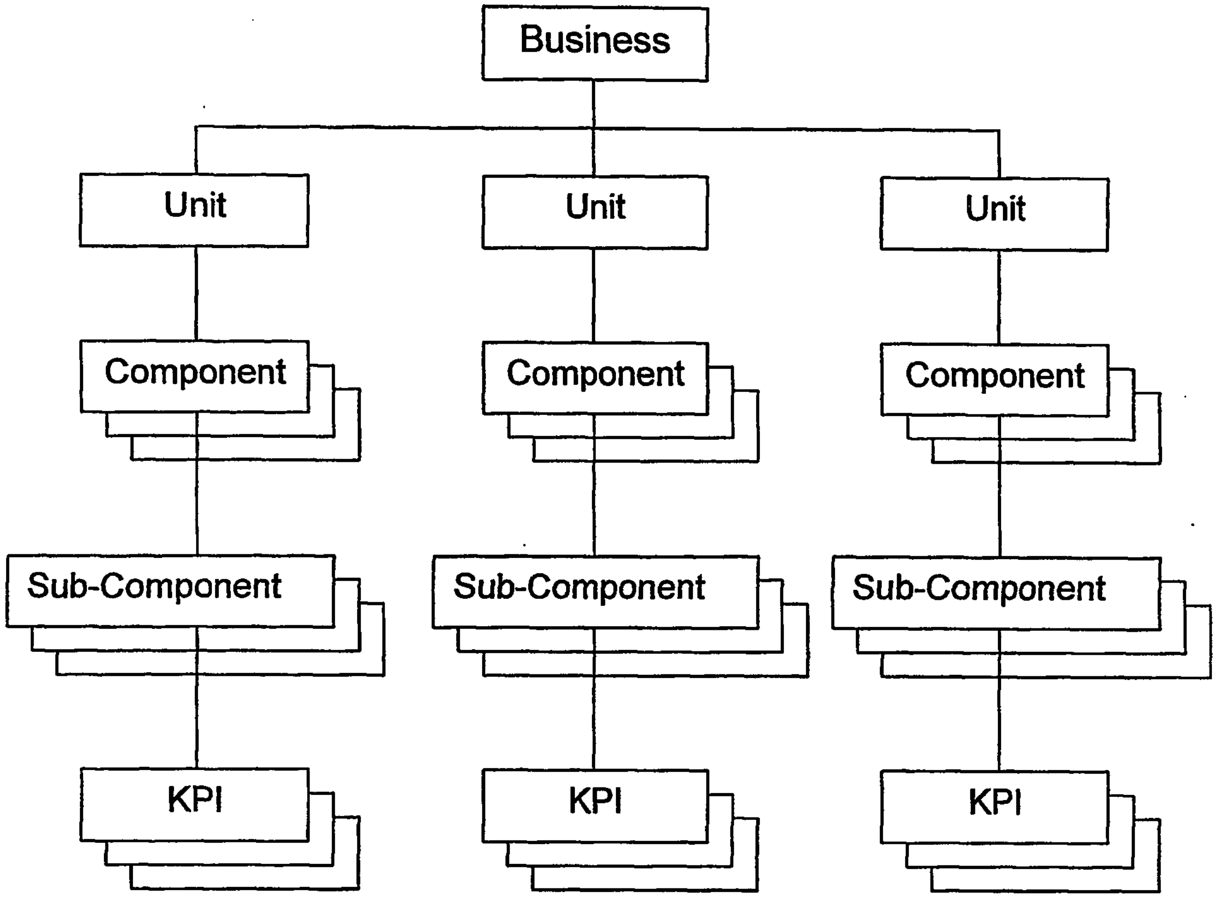
Business
Unit
Unit
Unit
Component
Component
Component
Sub-Component
Sub-Component
Sub-Component
KPI
KPI
KPI

FIG 2


X_i
KPI
B_i
Z_i

FIG 3

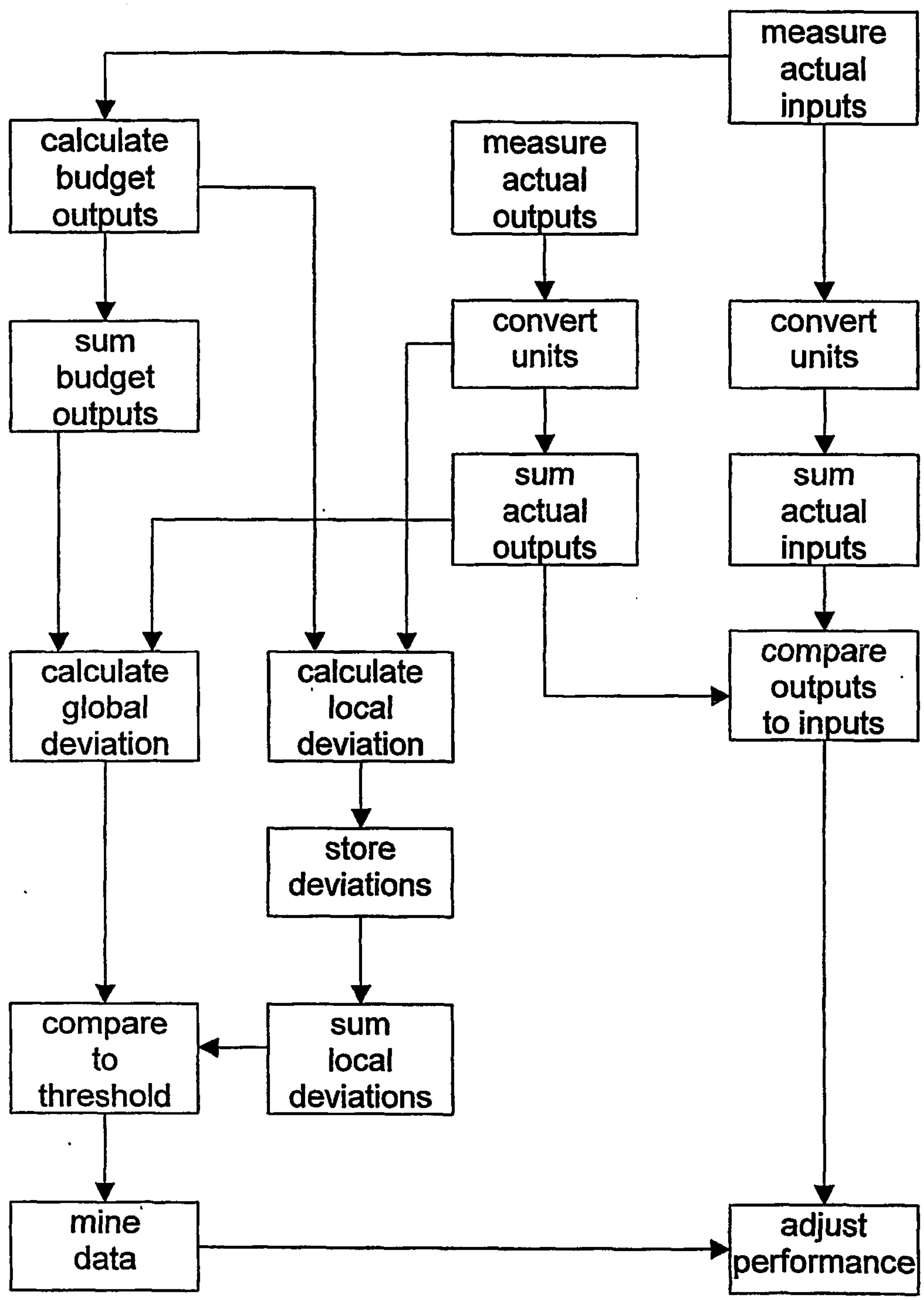
measure actual inputs
calculate budget outputs
measure actual outputs
sum budget outputs
convert units
convert units
sum actual outputs
sum actual inputs
calculate global deviation
calculate local deviation
compare outputs to inputs
store deviations
compare to threshold
sum local deviations
mine data
adjust performance

FIG 4

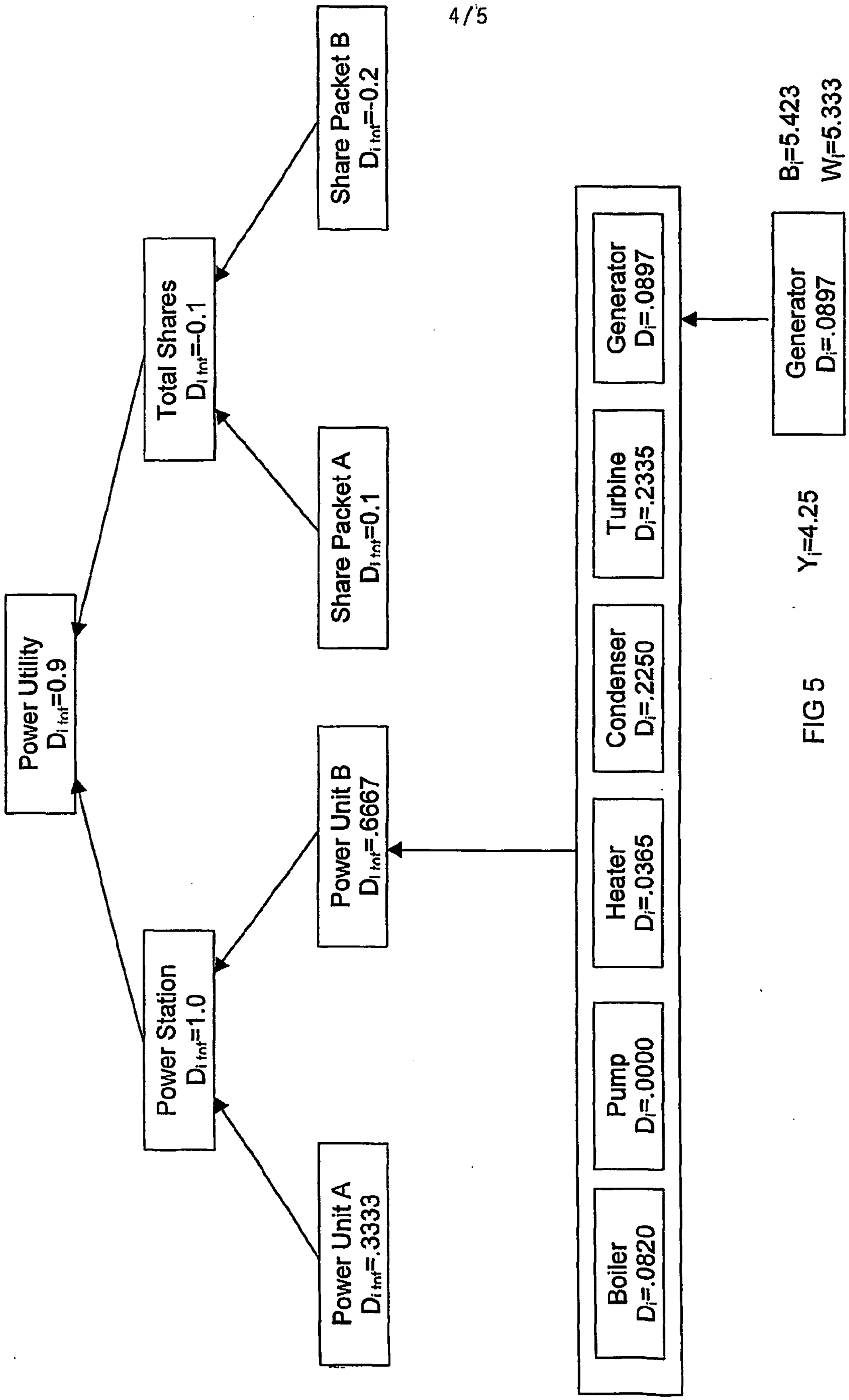
Power Utility
$D_{i\,tnf}=0.9$
Power Station
$D_{i\,tnf}=1.0$
Total Shares
$D_{i\,tnf}=-0.1$
Power Unit A
$D_{i\,tnf}=.3333$
Power Unit B
$D_{i\,tnf}=.6667$
Share Packet A
$D_{i\,tnf}=0.1$
Share Packet B
$D_{i\,tnf}=-0.2$
Boiler
$D_i=.0820$
Pump
$D_i=.0000$
Heater
$D_i=.0365$
Condenser
$D_i=.2250$
Turbine
$D_i=.2335$
Generator
$D_i=.0897$
Generator
$D_i=.0897$
$Y_i=4.25$
$B_i=5.423$
$W_i=5.333$

FIG 5

5/5

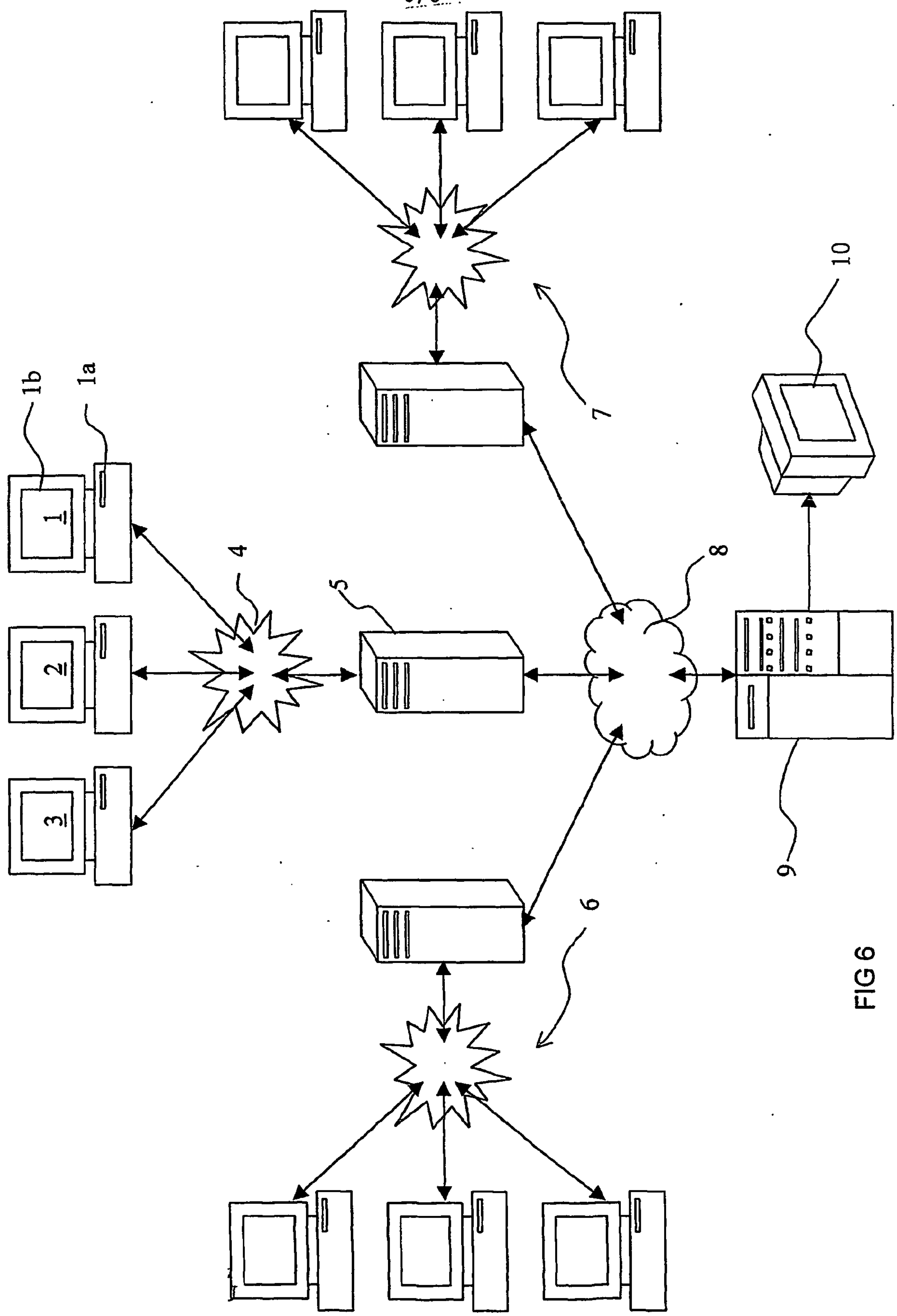

FIG 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/00532

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. 7: G06F 17/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU:IPC AS ABOVE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT, USPTO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	EP 1072988A, VISION COMPASS INC, 31 January 2001	
P,A	WO 0131539A, MARKET DATA SYSTEMS INC, 3 May 2001	
A	EP 438168A, HITACHI LTD, 2 December 1998	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 June 2001	27 June 2001

Name and mailing address of the ISA/AU	Authorized officer
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU01/00532

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
EP	1072988	NONE			
EP	438168	JP	3214352	US	5331543
WO	0131539	NONE			

END OF ANNEX